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ABSTRACT

Different ways student-generated learning issues are used to deal with disciplinary content were assessed at seven North American medical schools with problem-based curricula. Structured interviews with key faculty representing the schools being studied suggested that the seven programs are encouraging the development of self-directed learning skills to differing degrees. Reports from administrators and librarians also suggested that at those schools where student-generated learning issues have been de-emphasized in favor of faculty learning objectives and reading lists, students may not be helped to become independent self-directed learners by that aspect of the curriculum. It is postulated that when students are given specific reading assignments and are not evaluated on their self-directed learning skills, the motivation for self-directed learning is likely to be diminished. It is also assumed that students at the problem-based learning programs that are using their own learning issues are developing self-directed learning skills through the process involved in case discussions; an assumption that requires validation. Contains eight references. (GLR)

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THE USES OF STUDENT GENERATED LEARNING ISSUES BY 7 PROBLEM BASED MEDICAL CURRICULA

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Structured interviews were conducted with key faculty representing seven North American problem based learning curricula on their programs' use of student generated learning issues. These are learning objectives which the students decide are prerequisites to a better understanding of the problem. The implementation of problem based learning at each of these schools varies. The uses of student generated learning issues has evolved and changed in terms of content definition, directing examination planning, student evaluation and curriculum review. Theses varied uses form a continuum for defining curricular content to be mastered. At 6/7 of these schools, students may have access to faculty objectives. Student generated learning issues have been de-emphasized in favour of faculty objectives and reading lists at two schools. At 5/7 schools the students are evaluated on their ability to generate learning issues. The survey results suggest that these curricula may be encouraging the development of self-directed learning to differing degrees.

Problem based learning is consistent with Rossman's[1] definition of a "free learning group". Within free learning groups, learners are more motivated because the learning is tied in with the individual's social roles, perspectives and values; is seen as relevant to future practice; and reflects the natural ways people learn. Problem based learning is integrally connected with question generation and case building; that is deciding what is important. In contrast to traditional teaching, problem based learning is abstracted from life and builds upon how the students see the world since the students generate their own learning issues.

In "classical" implementations of problem-based learning in medicine,[2-4] student generation of learning issues plays a central role in 1.) stimulating the development of self-directed learning, and 2.) defining what constitutes student mastery of content. Problem-based learning has, however, evolved since its early implementation at McMaster University,[5] and the ways in which student-generated learning issues are used now varies considerably. We will describe the different ways in which such learning issues are used to deal with disciplinary content at seven North American medical schools with problem-based curricula. We will also discuss the possible implications of these differences on the extent to which self-directed learning is promoted.

Student Generated Learning Issues in Problem-Based Learning

Problem (case) based learning generally involves the following steps. Medical students, meeting in small discussion groups (usually less than 10 students) with a faculty tutor or facilitator attempt to solve the case that has been presented to them. As they proceed, they identify topics or concepts about which they need more knowledge or greater understanding. To help focus their study of these subjects, the students generate "learning

issues" or "learning objectives", i.e. factual or conceptual domains that each group decides are prerequisites to a better understanding of the case under discussion. Since the approach emphasizes student-generated learning issues, the students must set their own learning objectives and learn what they think is relevant. Learning is, thus, more likely to be internally motivated or self directed. In a preclinical curriculum, learning issues most often are explanations or mechanistic descriptions of the relevant basic science concepts. The most useful learning issues are those which are applicable to both the case at hand and to larger basic science or clinical concerns.

The development of learning issues proceeds throughout the case discussion. At the end of each session, the student group, together with the faculty tutor or facilitator, reviews the list of learning issues and determines which are the most appropriate for enhanced understanding of the case and for meeting current curricular goals. The students then study the selected learning issues, using their own chosen resources (e.g. textbooks, audiovisuals, discussions with faculty, etc.) to prepare themselves for a more thorough case discussion at the next group meeting. Upon reconvening to discuss the case after this period of study, the students have an opportunity to demonstrate the extent of their content mastery in a problem solving mode within the context of the clinical case. This discussion of the case allows the students to receive feedback from their peers on their contribution to the case discussion and their mastery of the underlying content.[6]

The faculty plays at least two roles in the process leading to student- generated learning issues. First, the faculty develops the problems to be studied by the students, presumably with specific objectives in mind (e.g. deal with common diseases, master the anatomical sciences etc.). The second role is to serve as the facilitator or tutor within each group, helping the student to generate appropriate and clear learning issues. Beginning

students develop broad or unanswerable learning issues, which a skilled facilitator helps to shape into clearly defined, researchable learning issues. The facilitator also helps to identify appropriate learning resources and ways of accessing the material to be learned. An expert facilitator subtly, yet persuasively, guides and encourages the students to generate learning issues. If the facilitators are not adequately trained and committed to the notion of problem based, self-direct learning there might be negligible effort at self-directed learning by the students. The facilitator's role is so essential, that even if a school decides that its curriculum policy will be self-directed learning, if the facilitators are not committed to this notion the outcome is more likely to be teacher directed, than self-directed learning.

METHODS

Although problem based learning schools unanimously recognize the key role served by tutors or facilitators, nevertheless the manner in which this role has been implemented differs across institutions. To examine this issue, we interviewed key people from the following North American Medical Schools with problem based curricula: Bowman Gray School of Medicine of Wake Forest University, Harvard Medical School, McMaster University School of Medicine, Mercer University School of Medicine, Michigan State University College of Human Medicine, Rush Medical College, Southern Illinois University School of Medicine and University of New Mexico School of Medicine.

An administrator, a curriculum director and/or a tutor from each of these seven North American medical schools was asked (in telephone interviews) questions regarding the use of student-generated learning issues at his/her medical school. In all schools, the respondents were intimately familiar with the actual small group functioning either through direct teaching or repeated observaions. They were also asked to give the "institutional" response and not their own opinions. The authors generated the questions for the

structured interviewing. The headings for the columns in Table 1 were the basis for the questions asked each respondent. Probing questions for further explanation and examples were also asked. All of the interviews were conducted by the first author and transcribed. The authors decided to interview the respondents twice because they were interested in changes in the use of student-generated learning issues over time, particularly with the newer problem based programs. Thus, the respondents from eight schools answered the same questions in 1987 and 1989. The second interview also helped clarify information. The results reported on in this paper show the most current and most complete data. (Southern Illinois University is not included in the data reported here. There is currently no systematic problem based learning in the present curriculum, although there was some in 1987, Barrows, personal communication, 1989.)

RESULTS (Insert Table 1 about here)

Content Definition As summarized in Table 1, each of the seven schools surveyed employs learning issues quite differently, and taken together these uses form a continuum for defining curricular content to be mastered. In a "classical" problem-based medical curriculum such as has been described and discussed by Barrows and Tamblyn[6] and by Neame,[2] the learning issues developed by the students are thought to define the entire disciplinary content that the students need to know. In this student centred model, a complete analysis of the case is thought to lead to a full exploration of the relevant knowledge domains. Schools at this end of the continuum, including McMaster University and the University of New Mexico (Primary Care Curriculum - the problem based curriculum) maintain the "classical" orientation in which student-generated learning issues define all of the content to be mastered. The University of New Mexico curriculum is the most student centred of all of the North American programs since faculty objectives for each

case are not available for comparison to the student learning issues. At McMaster, the tutor and the students can use faculty objectives as they progress through a case, but are encouraged to do this at the end of the problem.

Data from the University of New Mexico demonstrate that the primary care curriculum students self-select the great majority of their resources and use a greater variety of resources than the students in the traditional curriculum.[7] Although the curriculum planners at McMaster assume that the student-generated learning issues will define all of the content to be mastered, there is variability in the way tutorial groups implement this policy. Every problem has a tutor's guide which contains key learning objectives and suggested resources. This guide is supposed to help the tutor to ensure that the material is covered and to assist tutors with unfamiliar material. In some cases the students get these objectives and resources while they are still discussing the case; this may be seen as a departure from the "classical" problem based learning model (personal communication with Levine, Perdue and McMaster students, 1989).

At the other end of the spectrum are problem-based curricula which are faculty centred. In these programs the faculty have abandoned the "classical" position about student-generated learning issues. Two examples include Michigan State University College of Human Medicine (Track II) and Mercer University School of Medicine. At these schools, the role of student generated learning issues has been de-emphasized; the students and faculty have concentrated instead on the use of faculty generated objectives and specific reading assignments. Faculty from both of the these schools report that their students are essentially engaged in two more or less unrelated curricular tracks simultaneously, a problem based track and a content driven track. Students engage in independent reading to master the basic science content objectives. Case discussions may concentrate on specific issues

within a case and do not attempt to be comprehensive discussions of all issues.

The remaining three problem based curricula require students to determine their own learning issues but also make use of faculty derived objectives. At Bowman Gray (Parallel Curriculum), Harvard University Medical School, and Rush Medical College (Alternative Curriculum), the students generate their own learning issues but also can compare them against faculty-generated learning objectives, either most of the way through or after completing the discussion of a case. Thus, these three schools occupy the middle of the continuum regarding the use of student-generated learning issues. In the classical problem based curriculum, as well as in the more moderate problem based schools, there is some negotiation among the students and the faculty over the development and relative emphasis of student-generated learning issues.

Thus the data show that the majority of the problem based curricula do not adhere to the "classical" problem based learning model, with regard to content definition. Students do not define all of the content to be mastered. Faculty objectives are usually available to the students to help guide their learning. This blend of student-generated learning issues together with faculty objectives seems to be an effective compromise between a student centred and a faculty driven program. Even if an expert could define all of the learning issues that theoretically should be in the discussion of a particular case, it seems unreasonable to expect a student to perform in a similar manner. Furthermore, many faculty and students in problem based curricula think that there is additional important content that must be mastered even though it does not arise in any natural way as a learning issue from a case.

Learning Issues Relationship To Resource Sessions

Resource sessions are one to two hour periods in which basic science faculty meet with the students. During these sessions, students are able to ask questions and the faculty can "quiz" the students or explain difficult concepts. Resource sessions at the University of New Mexico, Bowman Gray and McMaster are scheduled individually by the groups. Each group initiates the resource sessions and the students entirely select the topics to be discussed based on their learning issues. At Mercer a review of the learning issues over several years determined that pathology and pharmacology were inadequately covered by the cases. Now these disciplines have their own overview sessions which run parallel to the case discussions. At the completion of each case the basic science faculty at Rush receive the learning issues generated for that case by all of the student groups. This rapid communication permits the faculty to check the topics covered and thus to better prepare for the scheduled resource sessions. Harvard schedules laboratories and resource sessions to be parallel to the content discussed in the cases. Students at Michigan State rarely have problem based resource sessions.

Examination Development

The examination development process varies considerably from school to school. The faculty-generated learning objectives determine the content of examinations at Harvard, Michigan State and Mercer. Faculty and students at Mercer have criticized their program in that it implicitly creates two simultaneous tracts - one that is problem based and one that is based on the NMBE examination. At two schools, Bowman Gray and Rush the lists of student-generated learning issues are collected and used in the examination development process. At Bowman Gray the examinations are made up and then are checked against issues to insure that the content has been covered adequately in the case discussion. Many

faculty at Rush have adopted a policy that the student-generated learning issues will determine the majority of the items on all basic science content exams. Therefore, all students routinely receive the list of learning issues generated by all of the groups for each case after completing the case discussions. Evaluations at McMaster and the University of New Mexico are derived from broad, unit wide objectives; learning issues from individual cases are not considered when these evaluations are developed.

Evaluation Of Ability To Generate Learning Issues

At five of the schools with problem based curricula, the students are evaluated on their ability to generate learning issues and to learn effectively from these issues. At Bowman Gray, Harvard, McMaster, Rush and University of New Mexico, each student individually discusses a case either in writing or orally with a faculty examiner, generates personal learning issues to direct study, prepares for the next round of assessment through study or searching available resources, and then finally has an oral discussion on the same case with a faculty examiner. Thus, these students are evaluated on the ability to generate and resolve learning issues.

At Mercer and Michigan State, the examinations are completely closed book, without the opportunity for the students to correct their thoughts after consulting resources. The students at these schools do not have the opportunity to develop learning issues during examinations and are not evaluated on their ability to learn from their own learning issues. These students may come to realize that such skills are not important for success in their schools.

Curriculum Review

Student-generated learning issues play a varying role in curriculum review. At Michigan State and Harvard these learning issues are not saved, and are not used in

curriculum review. Bowman Gray, on the other hand, is saving all of the learning issues generated by the students. A comparison with the faculty learning objectives has not yet been undertaken but will occur as part of a major curriculum review after the curriculum has been in existence for at least six years (Camp, personal communication, 1989). In contrast, at the end of each quarter the faculty at Rush formally review all the student learning issues generated that quarter. The student-generated learning issues are seen as integral to the entire curriculum to a much larger extent that at other problem based schools. In fact, Rush reviewing student-generated learning issues is seen as a way of practising quality control of the problem based curriculum. At McMaster, students indicate if key concepts on a master list of faculty learning objectives were emphasized, explored, or not explored. The curriculum planners receive a summary of the extent to which the faculty learning objectives were emphasized or explored on a unit to unit basis rather than a case by case basis. These summary data serve as guides for curriculum review at McMaster.

The overall congruence between faculty learning objectives and student-generated learning issues seem to be a consistent finding at those schools that have systematically checked this issue.[8] Curriculum planners at Mercer checked the student-generated learning issues against the faculty learning objectives for each case; generally 80 - 90% of the faculty objectives were covered in the student learning issues (Menninger, personal communication, 1989). At the University of New Mexico during the first few years of the Primary Care Curriculum there was such a good match between the faculty objectives and the student learning issues that checking was discontinued (Mennin, personal communication, 1989.) However, there is a possibility that they may do so again in order to consider a major curriculum revision.

DISCUSSION

Although one important goal which all of problem based curricula share is to assist students in the development of self-directed learning skills, the survey suggests that the seven programs may be encouraging the development of such skills to differing degrees. The process of defining and using student- generated learning issues may be an essential element in the development of self-directed learning skills; therefore, at these schools where student-generated learning issues have been de-emphasized in favour of faculty learning objectives and reading lists, this aspect of the curriculum may not be assisting students to become independent self-directed learners. This hypothesis is supported by reports from administrators and librarians. In one school where the students read only assigned material and rarely utilize additional, self-selected materials, librarians report that they have little contact with their problem based curriculum students.[7] In contrast librarians from the problem based schools that rely heavily on student-generated learning issues report extensive contact with the problem based curriculum students

Whenever these student-generated learning issues appear irrelevant to the students, these issues are unlikely to be central to student learning and self-directed learning may occur to a lesser extent. It seems plausible that when students are given specific reading asignments, and are not evaluated on their self-directed learning skills the motivation for self-directed learning is likely to be diminished. We may presume that students at the problem based learning programs that are using their own learning issues, they are developing self-directed learning skills through the process involved in case discussions. Of course, systematic research is necessary to validate this assumption.

CONCLUSIONS

In 1989, at least seven medical schools in North America had a problem based curriculum. The implementation of Barrows'[6] original ideas of problem based learning is widely different. The uses of student-generated learning issues has evolved and changed in the past decade in terms of content definition, directing examination planning, student evaluation and curriculum review. The authors hypothesize that these changes have implications for the development of self-directed learning skills.

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TABLE I
USE OF STUDENT GENERATED LEARNING ISSUES AT NORTH AMERICAN MEDICAL SCHOOLS WITH A PROBLEM BASED CURRICULUM

School	A) Are Learning Issues Used To			B) Are Learning Issues Used To Communicate To Faculty?		C) Are Students Evaluated On Their Ability To Generate Learning Issues? How?
	Guide Learning?	Plan Exams?	Review Curriculum?	If yes, for what purpose?	Saved & Collected?	
Bowman Gray Parallel Curriculum	Yes. Students measure their own issues against faculty objectives at end of unit.	No. They are used only after exam development to check on coverage.	No, but perhaps in the future. Cases are cross referenced with learning issues.	No.	Yes. Used for checking exam content and in future for curriculum review.	Yes. On first attempt on some evaluations students generate learning issues. They then study from learning issues for oral exam which follows.
Harvard	Yes. Students measure their own issues against faculty objectives which are made available part way through the case.	No. Exams are planned from faculty objectives.	Only to a small extent. Faculty use their objectives more. Students sit on review committees.	No.	No.	Yes. On first attempt on some evaluations students generate learning issues. They then study from learning issues for oral exam which follows.
McMaster	Yes. within the context of faculty objectives for unit and case.	No. Students evaluations come from unit objectives.	Yes. As students evaluate whether cases meet faculty program wide objectives.	Slightly. Planners receive a summary of the extent to which broad Faculty objectives were emphasized. Case specific issues are not communicated to faculty.	No.	Yes. On first attempt on some evaluations students generate learning issues. They then study from learning issues for oral exam which follows.
Mercer	Only to a small extent. Each cases'study guide contains faculty objectives and reading lists which guide student learning more than issues.	No. Exams are planned from unit objectives.	No. Although were used in the past to check that student's learning issues were similar to faculty objectives.	No.	No.	No.
Michigan State University Track II	No. Faculty generated objectives and reading lists guide student learning.	No. Exams are planned from faculty objectives.	No.	No.	No.	No.
Rush Alternative Curriculum	Yes. Students measure their own issues against faculty objectives at the end of the case.	Yes. Students' issues determine many of the exam items.	Yes. Major review tool.	Yes. Used to help faculty to prepare for resource sessions.	Yes. Used for exam development, become part of the case.	Yes. On first attempt on some evaluations students generate learning issues. They then study from learning issues for oral exam which follows.
U. of New Mexico Primary Care Curricu-	Yes. They determine what shall be learned.	No. Exams are planned from broad unit objectives.	No. Although were used in the first 2 years to check that student's learning issues were similar to faculty objectives.	No.	No.	Yes. On first attempt on some evaluations students generate learning issues. They then study from learning issues for oral exam which follows.